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ABSTRACT

A semantic web visually represents concepts and their relationships in an organized schema. It is an aid to comprehending printed material in a more concrete way through the illustration of main ideas, supporting details, and their relationships in a reading selection. A semantic web consists of four basic components: (1) a core question asked by the teacher to stimulate and direct student discussion; (2) web strands consisting of the answers gleaned from the students' discussion; (3) strand supports, the facts or information in the selection that support the web strands; and (4) strand ties that indicate supporting details as well as interstrand relationships. Among the steps teachers might follow in developing a semantic web for a selection in science are developing a core question, having students read with the core question in mind, listing the students' responses on the board, and assisting the students in determining relationships among the strand supports. (JL)

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SEMANTIC WEBBING

IN

SCIENCE

A Paper Presented At The

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by

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SEMANTIC WEBBING IN SCIENCE

One of the perennial concerns of science teachers is the difficulty their students experience in understanding the concepts of their subject matter. While their students have little or no difficulty in decoding the words in their textbooks, they encounter problems in understanding or comprehending the content. Specifically, they have difficulty extracting the information from the text, providing an accurate evaluation of the concepts, and communicating a meaningful interpretation of the concepts and their relationships.

Learning theories provide several principles that apply in assisting teachers in helping their students understand what they have read. For example, we know that the more concretely new information is presented to the learner, the more likely learning is to occur. The more the new material can be related to the learner's repertoire of past experiences which links the "old" with the "new," the more meaningful the material becomes. Furthermore, the more purposefully and directly involved the learner is in the experience, the deeper the level of understanding. Several recent investigations (Barron, 1969; Manzo, 1975; Pearson and Johnson, 1978; Freedman and Reynolds, 1980; Ankney and McClurg, 1981; Novak, 1979, 1980, 1981; Cleland, 1981; Whaley, 1981; Thelen, 1982; Davidson, 1982 and Vacca, 1977) and others have suggested that visual or graphic representations that organize printed materials have important implications for assisting in the comprehension of information to be learned.

One of the graphic techniques that has been advocated in the field of reading as an aid to the comprehension of literature is semantic webbing (Freedman and Reynolds, 1980; Cleland, 1981). The semantic web, which holds promise

as a teaching aid in science, is an instructional technique that directly involves the learner in a purposeful experience with written materials (Manzo, 1975; and Ankney and McClurg, 1981). It may be seen as a means to an end, with the end being the understanding of the content of the materials being read.

Novak (1979, 1980, 1981) has described the importance of encouraging meaningful learning rather than rote learning in science classes. He advocates concept mapping as a way to link knowledge that students know and/or are acquiring. Semantic webbing--like concept mapping--is a way of providing a two dimensional representation of the learner's structure of knowledge in a discipline. These graphic techniques encourage more meaningful learning in students. They also help teachers evaluate the cognitive structures students have formed in a discipline area.

Similar to concept mapping, the semantic web is a process for organizing and integrating information by constructing a visual classification of concepts and their relationship to each other (Freedman and Reynolds, 1980). In reading, for example, the semantic web can be used to show relationships between characters and events of a story (Cleland, 1981). In science, the web can provide a means of reconstructing major concepts through a visual model of main ideas connected by strands of related details. In short, the completed web is an aid to comprehending printed material in a more concrete way through the illustration of main ideas, supporting details, and their relationships in a selection.

In his description of reading, Thorndike compared the processes involved in reading to those of thinking. He stated:

> The reading of a paragraph involves the same sort of organization and analysis as does thinking. It includes learning, reflecting, judgment, analysis, synthesis, problem-solving behavior, selection, inference, organization, comparison of data, determination of relationships, and critical evaluation of what is read. It also includes attention, association, abstraction, generalization, comprehension, concentration and deduction (Thorndike, 1917).

The semantic web is a reading-thinking strategy that is jointly developed by the teacher and student. While the construction of the web is teacher directed, it is drawn from the students' contributions. First, the teacher provides a purpose setting question, called a core question, as a strategy for directing the reading-thinking process involved in comprehending the material. The passage to be read should be of manageable length. After reading the selection, the teacher directed or core question is then used as a springboard for the students' discussion. Each contribution of the students is accepted for discussion and evaluation to determine its inclusion in the web. The teacher serves as a facilitator for the discussion with the completion of the web jointly determined by the teacher and students. There is no perfect semantic web since individual students and classes vary in what they read and comprehend about any particular question.

The four basic components of the constructed web are the core question, the web strands, the strand supports, and the strand ties (Freedman and Reynolds, 1980).

The core question is the teacher selected question that sets the purpose for reading and the direction of the discussion to follow. The core question then is the focal point of the information contained in the students' discussion which is related to this question. A core question such as "What are the three basic types of clouds?" is an example of a science inquiry (see Figure 1).

The web strands are the answers gleaned from the students' discussion. The answer to the core question proposed above would have three strands to be included in the schemata, i.e., "cirrus," "cumulus," and "stratus" (see Figure 1).

The strand supports are the facts or information in the selection that support the web strands. This information may be literally or inferentially

drawn from the facts presented. To be included as a strand support, it should add clarity to the strand. Using the model of the "cloud web" (See Figure 1), the supporting facts or details regarding cirrus clouds might include that they are "feathery or fibrous clouds," formed at very high altitudes," "composed of ice crystals," and "sometimes called Mare's tails," (Coble, Murray, and Rice, 1981).

The strand ties indicate supporting details as well as interstrand relationships. These relationships may be based on similarities or differences in the strand supports. Returning to the clouds as an example (see Figure 2), the strand ties might show that while rain is associated with both cumulonimbus and nimbostratus, the former may produce severe thunderstorms while the latter may be only a rain and drizzle (Coble, Murray, and Rice, 1981). Figure 3 illustrates another semantic web developed around the core questions, "What are the different kinds of plants?" (Webster, et.al., 1980). The samples provided in this paper were selected from textbooks. However, the same task could be applied to reading tradebooks, reference materials and science-related magazines such as Science 82, Discovery, or Science Digest.

In summary, a semantic web visually represents concepts and their relationships in an organized schemata. The concepts and their relationships result from the readings and discussions related to a core question which sets the purpose for the inquiry. The information to be included in the semantic web is selected from the discussion and categorized for inclusion in the web. The teacher and student work in partnership to develop a visual model of printed material.

The following are some suggested steps teachers might follow in developing a semantic web for a selection in science:

1. Develop a core question to provide a purpose for reading and inquiry into the science material.

2. Write the core question at the focal point of the developing web.

3. Have the students read the science selection with the core question in mind.

4. Follow the reading of the selection by having the students brainstorm answers to the core question.

5. List the answers or responses of the students on the board.

6. Have the students discuss (exclude, include, or regroup responses) and categorize them for the web.

7. Have the students create a title or brief description for each category to be included as strand supports.

8. Guide the students in their recollection of important facts from the selection to be included as strand supports.

9. Assist the students in determining relationships among the strand supports.

10. Add the clarifying support ties that result from the discussion to the expanding web.

Figure 1

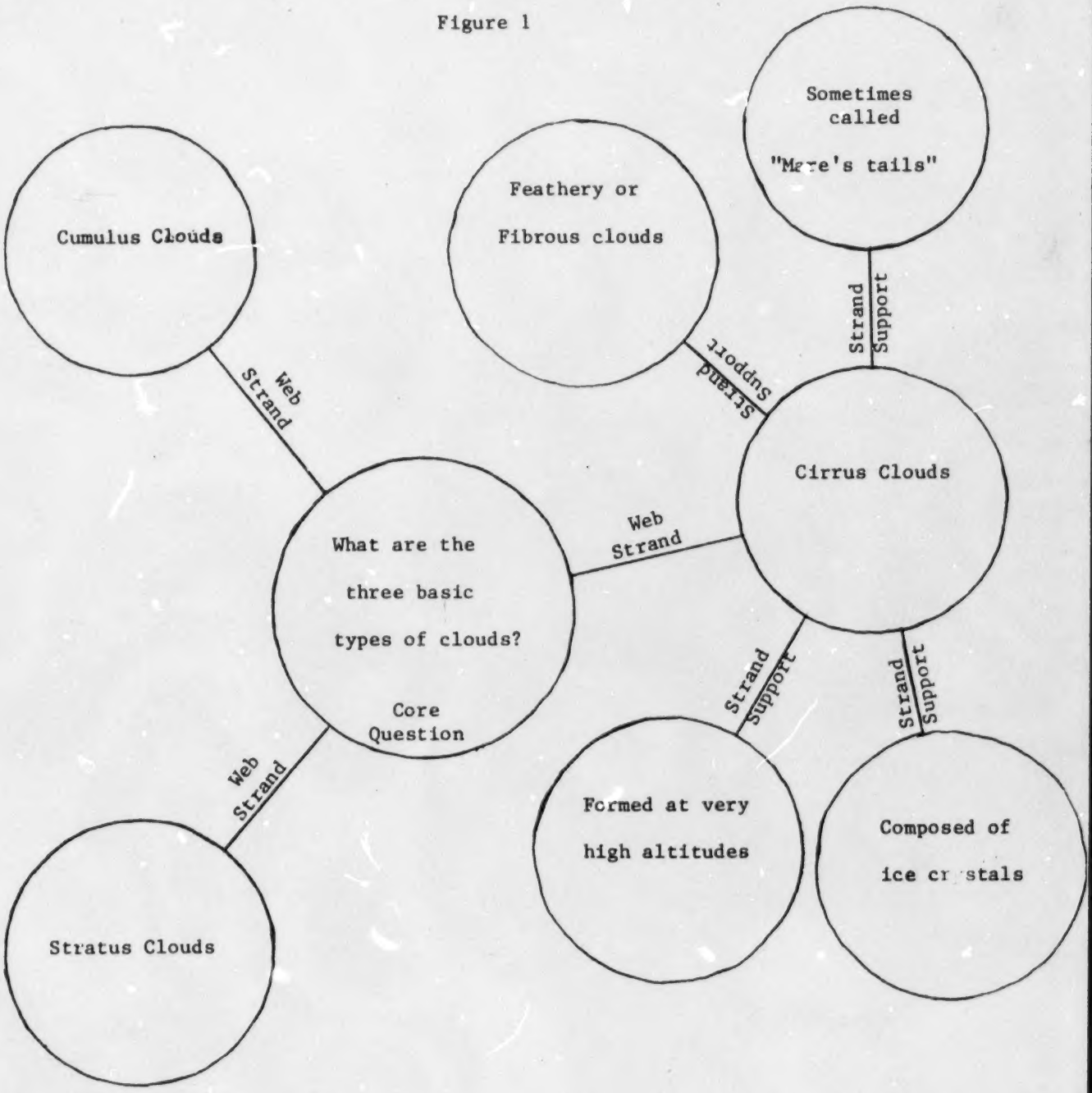
Sometimes called "Mare's tails"
Feathery or Fibrous clouds
Cumulus Clouds
Strand Support
Strand Support
Web Strand
Cirrus Clouds
What are the three basic types of clouds?
Core Question
Web Strand
Web Strand
Strand Support
Strand Support
Formed at very high altitudes
Composed of ice crystals
Stratus Clouds

Figure 2

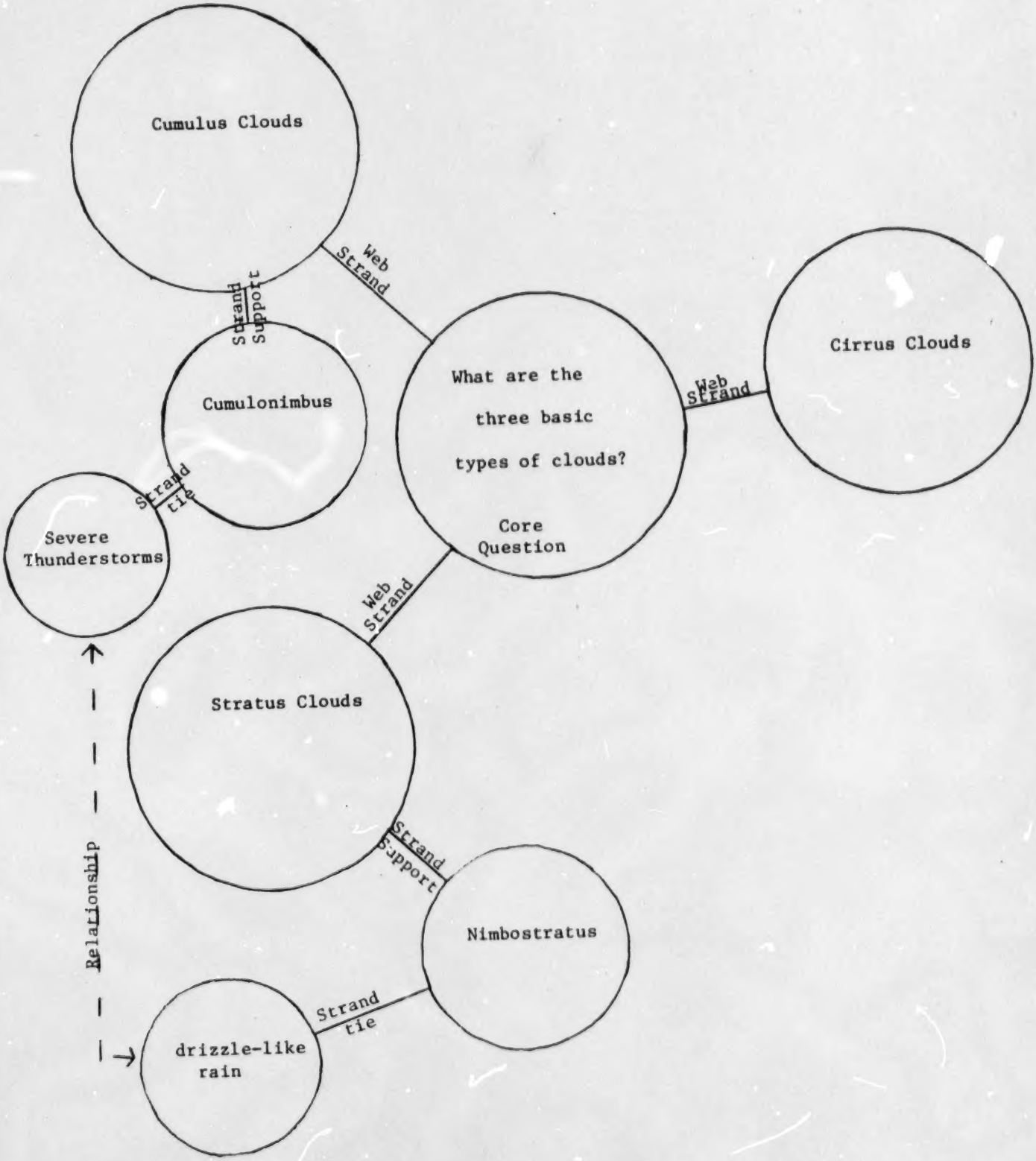
Cumulus Clouds
Web Strand
Strand Support
Cumulonimbus
What are the three basic types of clouds?
Core Question
Web Strand
Cirrus Clouds
Strand tie
Severe Thunderstorms
Web Strand
Stratus Clouds
Strand Support
Nimbostratus
Relationship
Strand tie
drizzle-like rain

Figure 3

SEMANTIC WEBBING